

Integrated Solar Thermal Collector with Heat Storage

A.R. Sánchez-Guitard¹, E. Ruiz-Reina¹

¹University of Málaga, Málaga, Spain

Abstract

Introduction

In this work, we study the design of a new integrated system for Solar Water Heating that combines the solar thermal energy collection (primary circuit) with the heat storage (secondary circuit) into the same device. It is devised to be a much less expensive indirect system than traditional ones and it also can offer freeze and overheat protections as well [1].

Use of COMSOL Multiphysics®

We have performed different finite element method simulations using COMSOL Multiphysics®, for solving the equations of heat transfer (conduction and convection) and those of fluid flow, for obtaining:

- a) the stationary temperature distribution and thermal energy stored under different solar irradiation and climatic conditions, and
- b) the transient thermal behaviour when the system is active, i.e., when there is water flowing through the primary circuit and it exchanges heat with the secondary circuit.

These calculations are a fundamental part in the preliminary study prior to the patent presentation and construction/testing phase with a physical prototype. With this work we intend to obtain some practical information about the efficiency, the materials characteristics, the sizing and the installation conditions of this new solar system.

Acknowledgments

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Reference

1. Chris Laughton, Solar Domestic Water Heating, Earthscan Expert Series, 2010.